

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1–49. (Cancelled)

50. (Previously presented) A polymer article comprising a thermosetting polymer matrix and inorganic ultrafine particulate material evenly distributed through the polymer matrix wherein the inorganic particulate material has an average particle diameter from 1 nm up to 1000 nm at a particle loading of 0.01 - 20 wt% based on the total weight of the polymer and inorganic material, wherein the polymer article is substantially free of gas bubbles and the interparticle distance between the particles is less than 2 μ m to 10 μ m.

51. (Cancelled)

52. (Previously presented) The article according to claim 50, wherein the upper size limit of the particle is less than 800 nanometers.

53. (Previously presented) The article according to claim 50, wherein the particulate material has a size range of between 100-800 nanometers.

54. (Previously presented) The article according to claim 50, wherein the upper particle loading limit is 10 wt% based on the total weight of polymeric and inorganic material.

55. (Cancelled)

56. (Previously presented) The article according to claim 50, wherein the inorganic particulate material is an inorganic material available in submicron powder form, or a precursor to said inorganic particulate material, selected from the group including silicon carbide, metal oxides, metal silicates and metal alkoxides.

57. (Previously presented) The article according to claim 56, wherein the particulate material is an oxide, silicate, carbide or alkoxide of aluminium, titanium or silicon.

58. (Previously presented) The article according to claim 56, wherein the particulate material is selected from the group consisting of alumina (Al_2O_3), titania (TiO_2), zirconia (ZrO_2), silica (SiO_2), silicon carbide, hydroxides of aluminium and alumino-silicates.

59. (Previously presented) The article according to claim 50, wherein the particulate material is coated or treated with a dispersing agent to match the hydrophobicity of the particles with the polymer.

60. (Previously presented) The article according to claim 50, wherein the polymeric material is a polyurethane, polyester, hybrid or copolymer thereof.

61. (Previously presented) A method of forming a polymer-inorganic composite article comprising the steps of:

mixing an inorganic submicron particulate material having a particle size from 1 nm up to 1000 nm in a polymer at a loading rate of 0.01 to 20 wt% of the total weight of polymer and inorganic material, the mixing step preventing the formation of gas bubbles in the mixture to provide a dispersion having a substantially even distribution of particulate material in the polymer wherein the mixing step includes milling the particulate material with the polymer under sub-atmospheric conditions;

casting the dispersion into a mould; and
curing the mixture.

62. (Cancelled)

63. (Previously presented) The method according to claim 62, wherein the milling at subatmospheric conditions is carried out to minimize the amount of agglomeration of dispersed particles and provide a substantially even distribution of particles in the polymer.

64. (Cancelled)

65. (Previously presented) The method of claim 61, wherein the mixing is carried out in a low shear regime having a Reynolds number less than or equal to 1000.

66. (Previously presented) The method of claim 61, wherein the mixing is carried out in a high shear regime having a number much greater than 1000.

67. (Previously presented) The method of claim 61, wherein the particulate material is coated or treated with a dispersing agent to match the hydrophobicity of the particles with the polymer.

68. (Previously presented) The method of claim 67, wherein the dispersing or compatibilizing agent is selected from the group consisting of non-alcohol or non amine aromatic solvent.

69. (Previously presented) The method of claim 61, wherein the mixing occurs at under vacuum conditions to ensure no bubbles are formed in the dispersion.

70. (Previously presented) The method of claim 61, wherein the mixing occurs under a pressure of less than one atmosphere to ensure no bubbles are formed in the dispersion.

71. (Previously presented) The method of claim 69, wherein the mixing is conducted in a vacuum oven at a temperature above melting temperature and below the decomposition temperature of the polymer.

72. (Previously presented) The method of claim 61, wherein the mixing takes place in a vacuum up to 760 mm Hg with the level dependent on the viscosity of the dispersion.

73. (Previously presented) The method of claim 65, wherein the particulate material is added to a solvent carrier prior to addition to the polymer to form a slurry.

74. (Previously presented) The method of claim 73, wherein the solvent is removed by evaporation from the dispersion and the dispersion is cured to form a composite substantially free of gas bubbles.

75. (Previously presented) The method of claim 66, wherein the inorganic particulate material is dispersed in the polymer by milling the particulate material and polymer at a mill temperature, above the melting temperature resin but below the decomposition temperature of the polymer resin at a pressure below atmospheric pressure.

76. (Previously presented) The method of claim 61, wherein after the mixing step polymerisation is initiated by the addition of an initiator and the dispersion cured.

77. (Previously presented) The method of claim 61, wherein at least one other additive selected from the group consisting of anti-static agents, fillers, pigments, optical brighteners and UV brighteners are added to the dispersion prior to curing.

78. (Withdrawn) A method of dispersing an inorganic particulate material substantially homogeneously in a polymer, the particulate material consisting essentially of particles having a particle size from 1 nm up to 1000 nm at a loading rate in the range of 0.01 to 20 wt% based on the total weight of the particulate and polymer material, the method comprising the steps of combining the particulate material and a powder of the polymer under sub atmospheric pressure conditions, thereby preventing the formation of gas bubbles in the mixture, the combination being milled at a temperature above the melting temperature but below the decomposition temperature of the polymer to form a dispersion, and curing the dispersion.

79. (Cancelled)

80. (Withdrawn) The method of claim 78, wherein the particulate material is added to a solvent carrier prior to addition to the polymer to form a slurry, the solvent carrier being evaporated from the dispersion.

81. (Withdrawn) The method of claim 78, wherein the milling is conducted at a pressure of typically less than 900 millibar (gauge).

82. (Withdrawn) A method of increasing the wear resistance of a polymer comprising the steps of:
dispersing an inorganic submicron particulate material having a particle size from 1 nm up to 1000 nm in a polymer at a loading rate of 0.01 to 20 wt% of the total weight of polymer and inorganic material, the dispersion step preventing the formation of gas bubbles in the mixture to provide a dispersion having a substantially even distribution of particulate material in the polymer;
and
casting the dispersion in a mould to cure the polymer.

83. (Cancelled)

84. (Withdrawn) The method according to claim 83, wherein the dispersing step is carried out to minimize the amount of agglomeration of dispersed particles and provide a substantially even distribution of particles in the polymer.

85. (Withdrawn) The method according to claim 84, wherein the mixing step includes milling the particulate material with the polymer under vacuum conditions.

86. (Withdrawn) The method of claim 85, wherein the mixing is carried out in a low shear regime having a Reynolds number less than or equal to 1000.

87. (Withdrawn) The method of claim 85, wherein the mixing is carried out in a high shear regime having a Reynolds number much greater than 1000.

88. (Withdrawn) The method of claim 85, wherein the particulate material is coated or treated with a dispersing agent to match the hydrophobicity of the particles with the polymer.

89. (Withdrawn) The method of claim 88, wherein the dispersing agent is propylene glycol monomethylether acetate.

90. (Withdrawn) The method of claim 82, wherein the mixing occurs at under vacuum conditions to ensure no bubbles are formed in the dispersion.

91. (Withdrawn) The method of claim 82, wherein the mixing occurs under a pressure of less than one atmosphere to ensure no bubbles are formed in the dispersion.

92. (Withdrawn) The method of claim 90, wherein the mixing is conducted in a vacuum oven at a temperature above melting temperature and below the decomposition temperature of the polymer.

93. (Withdrawn) The method of claim 82, wherein the mixing takes place in a vacuum up to 760 mm Hg with the level dependent on the viscosity of the dispersion.

94. (Withdrawn) The method of claim 85, wherein the particulate material is mixed with a solvent prior to mixing with the polymer material, with the particulate material, the polymer material and the solvent forming a slurry.

95. (Withdrawn) The method of claim 94, wherein the solvent is evaporated from the dispersion and the dispersion is cured to form a composite substantially free of gas bubbles.

96. (Withdrawn) The method of claim 87, wherein the inorganic particulate material is dispersed in the polymer by milling the particulate material and polymer at a mill temperature, above the melting temperature but below the decomposition temperature of the polymer resin at a pressure below atmospheric pressure.

97. (Withdrawn) The method of claim 82, wherein after the mixing step polymerisation is initiated by the addition of an initiator and the dispersion cured.

98. (Withdrawn) The method of claim 82, wherein at least one other additive selected from the group comprising anti static agents, fillers, pigments, optical brighteners and UV brighteners are added to the dispersion prior to curing.